

This lesson is part of a larger, comprehensive school garden guide called **Minnesota School Gardens: A Guide to Gardening and Plant Science** developed by Minnesota Agriculture in the Classroom in 2013. The entire guide is available at www.mda.state.mn.us/maitc.



Grade

High School

Materials/Preparation

- ☐ Teacher Material A – Photosynthesis – one per teacher
- ☐ Handout A – Photosynthesis Song – one per student
- ☐ Assessment A – Photosynthesis: We Can't Live Without It! – one per student

Photosynthesis

Minnesota K-12 Academic Standards

Science	9.4.2.2	Matter cycles and energy flows through different levels of organization of living systems and the physical environment, as chemical elements are combined in different ways.
Science	9C.2.1.3	Chemical reactions describe a chemical change in which one or more reactants are transformed into one or more products.
Language Arts	9.14.2.2 11.14.2.2	Write informative/explanatory texts, as they apply to each discipline and reporting format, including the narration of historical events, of scientific procedures/experiments, or description of technical processes.

Summary/Overview

The process of *photosynthesis* is compared to baking cookies. Students learn the ingredients and end product of photosynthesis. Next they demonstrate their knowledge of the process by writing a song.

Garden Connection

Garden plants use sunlight and water to thrive through the process of photosynthesis,

Background Information

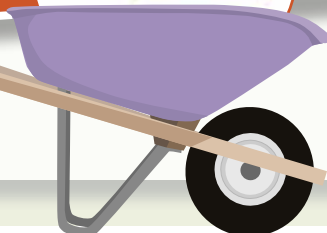
Plants are able to produce their own food through a process known as photosynthesis. They use energy from the sun to fuel a chemical reaction resulting in the production of glucose. Plants use the glucose they produce to grow and reproduce. The two other products of photosynthesis are oxygen and water. Plants do not need the oxygen and it is released as a byproduct. Humans benefit from the process of photosynthesis by utilizing the oxygen given off and eating fruits and vegetables produced by plants.

Objectives

- Describe the energy flow in the process of photosynthesis.
- List the beginning reactants or inputs and end products in photosynthesis.
- Apply the law of conservation of mass to photosynthesis.

Fun Fact

When first cultivated, green beans had a “string” that ran on the outer curve of the pod shell. This led to the nickname “string beans.” Botanists, however, found a way to remove the string through breeding and in 1894 the first successful stringless bean plant was cultivated. Today, nearly all varieties of edible pod beans are grown without strings.



Procedure

Interest Approach

Instruct students to make a list of ingredients used in baking cookies. Next have them describe the steps involved in baking cookies. Discuss student answers and list them on the board. Be sure to talk about inputs (ingredients), catalyst (warm oven temperature) and product (cookies).

Summary of Content and Teaching Strategies

Use Teacher Material A to show the photosynthesis diagram and equation. Arrows on the diagram indicate energy flow during photosynthesis. Carbon dioxide enters the plant through small openings called stomata. Water from soil is drawn up through the roots. Energy from the sun is absorbed by chlorophyll that is found in chloroplasts. Chlorophyll gives plants their green color by reflecting green light. It is within the chlorophyll that energy from the sun is able to convert carbon dioxide and water into glucose. Glucose is food manufactured by the plant. It is used to give the plant energy to grow and reproduce. Excess food is moved to the roots or stem to be stored in the form of sugar, starch or protein. Water and oxygen are byproducts of photosynthesis. Most photosynthesis occurs in leaves.

Discuss the concept of conservation of mass. Mass cannot be created or destroyed. This concept can be applied to the photosynthesis equation. Although the inputs undergo a chemical reaction, all molecules are accounted for in the product and byproducts. Add up the number of molecules for each element on both sides of the equation. They will be the same as no matter is gained or lost.

Provide students with copies of Handout A and review the details of their assignment. Students will be writing a Photosynthesis Song. Examples of songs can be found on [YouTube.com](https://www.youtube.com).

Review/Summary

Allow time for students to perform their songs for the class.

Modifications/Extensions

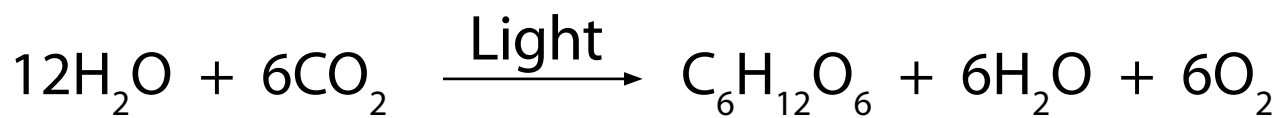
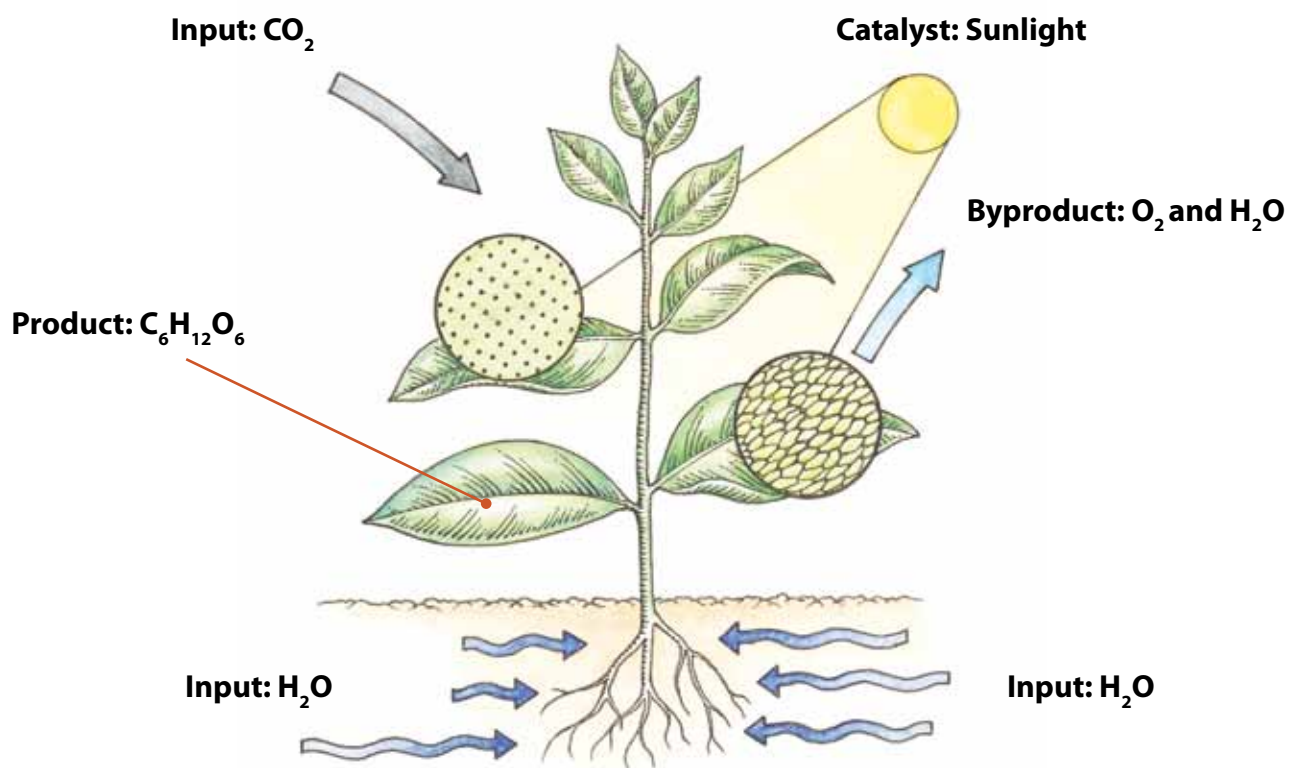
Explore the respiration process including the reactants and end products involved. Explain the function and importance of cell organelles for prokaryotic and/or eukaryotic cells as related to the basic cell processes of respiration and photosynthesis.

Have students research how seasons impact the photosynthesis process. Analyze how the rate of photosynthesis changes throughout the year. Instruct students to develop a pictogram illustrating photosynthesis during the span of one year. A pictogram is created when pictures are used instead of words.

Sources/Credits

This lesson was developed for the *Minnesota Garden Guide*.

Photosynthesis



Name _____



Photosynthesis Song

You are to rewrite the words to a song describing the process of photosynthesis. Songs can be written individually or in groups of two or three people. Choose a simple song such as a nursery rhyme or another song you know by heart like "Happy Birthday," "Take Me Out to the Ball Game," or "Whistle While You Work." Your song must include a chorus and three verses.

Make sure your song demonstrates your understanding of photosynthesis. The following words and definitions must be included:

- inputs
- products
- carbon dioxide
- sunlight
- photosynthesis

Include all items listed in the grading rubric

	Points Possible	Grade
Content		
Chorus	5	
Verse 1	5	
Verse 2	5	
Verse 3	5	
Describes photosynthesis	20	
Delivery		
Prepared Singers	5	
Creative	5	
Well organized	5	
Use of class time	5	
Total	60	

Name _____



Photosynthesis: We Can't Live Without It!

1. Describe the process of photosynthesis. You may write out the chemical equation, use words instead of symbols, or draw a picture. No matter which method you choose, be sure to include inputs, outputs, and the catalyst.

2. How does the law of conservation of mass apply to photosynthesis?

3. Explain how humans benefit from the process of photosynthesis.

4. How does human survival depend on photosynthesis?
